

We Claim:

1. A mould for horizontal casting of molten aluminum comprising a mould body forming an open ended mould cavity having an inlet end and an outlet end, a first annular permeable wall member mounted in the mould body adjacent the inlet end of the mould cavity with an inner face thereof forming an interior face of the mould, a refractory transition plate mounted at the inlet end of the mould cavity, said transition plate providing a mould inlet opening having a cross-section less than that of the mould cavity and thereby providing an annular shoulder at the inlet end of the cavity, feed means for feeding molten aluminum through said inlet opening, and first and second conduits for feeding a gas into said mould cavity, said first conduit positioned closer to the annular shoulder than the second conduit, whereby the first conduit is adapted to feed gas to form a metal free pocket at the corner of the shoulder and cavity wall and the second conduit is adapted to feed gas through said permeable wall means to contact the metal adjacent the interior face of the mould.

2. A mould as claimed in claim 1 which includes a third conduit for feeding a lubricant into the permeable wall member, said third conduit being located between the first conduit and the second conduit.

3. A mould as claimed in claim 1 in which the first conduit connects via grooves to the pocket for feeding gas into the pocket.

4. A mould as claimed in claim 1 in which the first conduit connects via the permeable wall to the pocket for feeding gas to the pocket.

5. A mould as claimed in claim 2 which also includes an impermeable barrier in the permeable wall means located between the first conduit and the third conduit.

6. A mould as claimed in claim 2 which also includes an impermeable barrier in the permeable wall means located between the second conduit and the third conduit.

10 7. A mould as claimed in claim 1 wherein the first conduit is connected to a source of more reactive gas and the second conduit is connected to a source of less reactive gas.

15 8. A mould as claimed in claim 1 that includes detectors located to measure the electrical resistance between the mould cavity wall and molten metal present in the mould during casting.

9. A mould as claimed in claim 1 wherein the mould cavity is outwardly tapered in the direction of metal flow.

20 10. A mould as claimed in claim 9 wherein the taper varies around the circumference of the mould cavity.

11. A mould as claimed in claim 1 wherein the mould inlet opening is non-circular in cross-section to produce an ingot having a circular cross-section.

25 12. A mould as claimed in claim 11 wherein the mould inlet opening is positioned asymmetrically.

13. A mould as claimed in claim 1 wherein the mould body includes coolant delivery channels connected to coolant discharge openings at the outlet end of the mould.

14. A mould as claimed in claim 13 wherein the
5 coolant discharge openings are in staggered locations and the opening sizes and discharge angles are varied around the mould.

15. A method for horizontal continuous casting of molten aluminum comprising:

10 continuously feeding molten aluminum from a feed trough through a opening in a refractory transition plate at the inlet end of an open ended mould cavity formed within a mould body, said transition plate providing a mould inlet opening having a cross-section less than that
15 of the mould cavity thereby providing a shoulder around the inlet end of the mould cavity,

within the mould cavity moving the molten aluminum past a permeable refractory wall portion forming part of the interior face of the mould cavity with the formation of
20 a metal meniscus adjacent the shoulder,

directing a first flow of a gas reactive with the aluminum into the shoulder to form a metal-free pocket and into contact with the molten aluminum to thereby form an aluminum body having an outer surface comprising a reaction
25 product of the gas with the aluminum, and

directing a second flow of gas into the mould cavity and into contact with the skin of the aluminum body downstream from said first gas flow.

16. A method as claimed in claim 15 wherein the gas
30 that is reactive with aluminum is selected from the group

consisting of oxygen, air, silane, SF₆ and methane or a mixture of an inert gas with one or more of said group.

17. A method as claimed in claim 16 wherein said reactive gas is a mixture of argon and oxygen.

5 18. A method as claimed in claim 15 wherein the second flow of gas passes through the permeable wall portion.

10 19. A method as claimed in claims 18 wherein the gas in the second flow is less reactive with aluminum than the gas in the first flow.

20. A method as claimed in claim 18 wherein the gas is selected from the group consisting of air, nitrogen and an inert gas.

15 21. A method as claimed in claim 20 wherein the gas is argon.

22. A method as claimed in claim 18 wherein a flow of lubricant is fed through the permeable wall portion and into contact with the skin of the aluminum body at a location between the first gas flow and the second gas flow.

20 23. A method as claimed in claim 22 wherein the flow of lubricant is prevented from coming into contact with the first gas flow before the first gas flow enters the mould cavity.

25 24. A method as claimed in claim 22 wherein the flow of lubricant is prevented from coming into contract with the second gas flow before the second gas flow enters the mould cavity.

25. A method as claimed in claim 15 wherein the gas is fed as a gas, a gas containing a liquid or a liquid containing a gas.

26. A method as claimed in claim 22 wherein the
5 lubricant contains a gas.

27. A method as claimed in claim 26 wherein the gas in the lubricant reacts with the gas in the pocket to form a modified reaction product on the aluminum body.

28. A method as claimed in claim 15 wherein the
10 molten aluminum is fed through a mould inlet opening that is non-circular in cross-section to obtain an ingot having a circular cross-section.

29. A method as claimed in claim 28 wherein the molten aluminum is fed through a mould inlet opening that
15 is positioned asymmetrically.

30. A method as claimed in claim 15 wherein streams of coolant liquid are directed onto a forming ingot as it emerges from the mould cavity.

31. A method as claimed in claim 30 wherein the
20 coolant liquid cools the forming ingot at a rate of more than 100°C/sec. thereby forming a fine grain structure within the ingot.

32. A method as claimed in claim 15 wherein an electrical resistance is measured between the mould and an
25 ingot being formed within the mould and the flow of lubricant to the permeable wall of the mould is varied based on the measured resistance.

33. A mould for casting of a molten metal comprising a mould body forming an open ended mould cavity having an inlet end and an outlet end, said mould cavity including a permeable wall portion forming an interior face of the mould, feed means for feeding molten metal through the mould cavity to form a metal ingot, conduits for feeding gas and a lubricant through said permeable wall portion and into contact with metal adjacent the interior face of the mould, and means for controlling the amount of lubricant being fed to the mould cavity comprising detectors located to measure the electrical resistance between the mould cavity wall and molten metal present in the mould during casting, said electrical resistance being indicative of the amount of lubricant in contact with the metal.

34. A cast aluminum or aluminum alloy billet obtained by continuous casting, said cast billet having a uniform as cast microstructure with an average inter-dendritic arm spacing of less than 10 microns

35. A cast billet as in claim 34 having a surface roughness (R_z) of less than 50 microns over at least 50% of the circumferential area.